into a state of stupor, and in this condition—almost oblivious of everything that went on around him—he remained until he passed into the silence of death.

But let us forget these events. However dark they may seem to be, they cannot hide from us the wonderful applications of science we owe to Lesseps.

We learn from the *Times* that Mdme. de Lesseps has received many messages of condolence. The Emperor of Germany telegraphed to her, "All intellectual and scientific people mourn over the tomb of one of the greatest minds and of a genius which embraced the universe." Lord Dufferin has conveyed the sincere grief of the Prince of Wales, as also the sympathy of Lord Kimberley. It is understood that a committee of the Suez Canal Board is to propose to the company that a statue be erected to M. de Lesseps at the expense of the company, and that the city of Paris is to be asked to grant a site in one of the public squares.

These expressions show the high regard in which de Lesseps was held. A still more striking testimony is afforded by the fact that the Paris Academy of Sciences adjourned on Monday in sign of mourning, when the president, M. Lœwy, is reported to have said: "Many storms had latterly broken over the head of the illustrious veteran. It is, perhaps, not to be too much regretted that his declining strength had for several years made him almost a stranger to the melancholy affairs of this world. His name will for ever be linked with a grand work, the success of which is due entirely to his glorious efforts, and will be a memorable date in the history of civilisation."

Scientific posterity will remember the Academy's act of respect to de Lesseps, and M. Lœwy's words of tribute to his colleague's memory.

NOTES.

We are glad to see the report that M. Pasteur, who has been poorly for some little time, is improving in health.

Prof. G. Lewitzky, the Director of Charcow Observatory, has been appointed Director of Dorpat Observatory, in succession to the late Prof. L. Schwarz. Dr. L. Struve goes to fill Prof. Lewitzky's place at Charcow.

The Academy of Sciences of Berlin has granted a subsidy of 1200 marks to Dr. P. Kuckuck, to aid him in the investigation of the alga-flora of Heligoland.

We learn from the *Botanisches Centralblatt*, that Herr W. Siehe, of Berlin, has undertaken a botanical exploration of the almost unknown region of Cilicia Trachæa.

Considerable changes have recently been made in the scientific department of Smith College, U.S.A. The botanical department has been reorganised, and Dr. W. F. Ganong appointed professor. Miss Grace D. Chester, formerly instructor in botany, has been appointed instructor in cryptogamic botany.

Our correspondent at Cambridge has sent us the following notes:—The Council of the Senate have appointed Dr. R. D. Roberts to be a governor of the Royal Holloway College, Egham. Dr. H. H. Tooth, of St. John's College, has been appointed an additional examiner in medicine. The Walsingham Medal for biological research has been awarded to H. Burkill, assistant curator of the Herbarium. The following awards for Natural Science have been made at St. John's College: G. S. West, Royal College of Science, London, Foundation Scholarship of £80 a year; E. F. Hudson, Dulwich College, and T. F. R. McDonnell, St. Paul's School, Minor Scholarships of £50 a year; A. C. Ingram, Felsted School, Exhibition of £30.

A Société des Amis des Explorateurs francais has recently been formed at Paris. Its object is to collect and administer funds for the purpose of aiding travellers, particularly in their return, and to contribute to the progress of geography by the publication of the results of explorations, and other contributions to geographical science. The Society is in connection with the Paris Geographical Society.

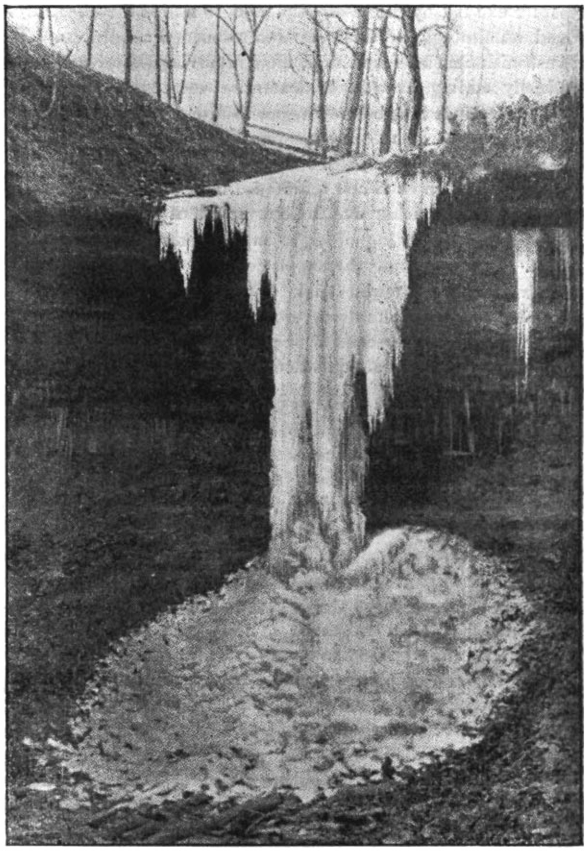
We thought it would come. The anti-vaccinationists, anti-vivisectionists, and kindred souls have, if only for the sake of consistency, protested against the new treatment for diphtheria. At the ordinary fortnightly meeting of the Metropolitan Asylums Board, on Saturday last, a deputation, headed by Lord Coleridge, waited upon the Board to present a memorial against experiments being carried out in the hospitals in the Metropolitan Asylums district in the use of the anti-toxin cure for diphtheria. The Royal College of Physicians had offered to supply serum for the treatment of diphtheric patients in the Board's hospitals, and the General Purposes Committee advised the acceptance of it, but the deputation wished to stop the action altogether. By arguments that have been used over and over again, it was urged that the experiments led to injurious effects, and were of doubtful utility. Therefore, the deputation submitted, "public money ought not to be devoted to experiments in physiology." The Board, however, thought differently, for the report of the Committee was adopted.

Prof. W. C. McIntosh writes on the artificial hatching of marine food-fishes in *Science Progress* for December. In the course of his article, he pleads for increased funds to carry on experiments on a larger scale than is at present possible at Dunbar. The sum of £3000 per annum is granted to the Scottish Fishery Board for scientific investigations, but really only £1800 a year is available for research. "This income has to bear the salaries of the staff, experiments in fish-, lobster-, and mussel culture, the cost of apparatus, the marine laboratory at St. Andrews, the hatchery for marine fishes, with its small laboratory at Dunbar, and the carrying out of other scientific fishery work." Leaving England out of consideration, compare this with what is done on the other side of the Atlantic. "The United States spends annually £70,000 on fish-culture and scientific investigations, and employs two large steamers and a sailing vessel exclusively for the work. Besides this large sum, the Fish Commissioners of the various States also disburse considerably on the development of their fisheries. Canada, again, expends £100,000 yearly on her fisheries, of which a sum of about £10,000 is devoted to fish culture."

It was pointed out by Lord Rayleigh in these columns in 1883 (vol. 27, p. 535), that whenever a bird pursues its course for some time without moving its wings, we must conclude either (1) that the course is not horizontal, (2) that the wind is not horizontal, or (3) that the wind is not uniform. Prof. S. P. Langley's recently published memoir on the internal work of the wind shows that the condition represented by the third cause, which Lord Rayleigh believed must sometimes operate, always exists. The investigations described in the memoir distinctly prove that the wind is never a homogeneous current, but consists of a continued series of rapid pulsations varying indefinitely in amplitude and period. These pulsations undoubtedly help a bird to maintain its flight without working its wings or expending energy. This may be accomplished by a succession of ascents and descents; the ascents being made during the wind-gusts, and the descents during the lulls. Prof. George E. Curtis, of Washington, has lately investigated mathematically whether the third case of Lord Rayleigh's analysis is the one actually employed by a bird in soaring; that is to say, he has tested whether the pulsations of the wind, in addition to being qualitatively applicable, are also quantitatively sufficient to produce the result. (*Annals of Mathematics*, vol. viii. No. 6.) With this application in view, he has determined the course in the air of a free heavy plane subjected to definite wind pulsations. For a period of action of ten seconds, the following result was obtained "without any internal source of energy, during the 10 seconds of alternate calm and wind, the plane has in the first 2·75 seconds made a descent of 36 feet, and in the remaining 7·25 seconds has risen 46·9 feet, travelling at the same time horizontally a distance of 251 feet, of which 154 feet is made against the wind. In addition, the relative velocity of the plane and wind (58·9 feet per second) at the end of this period is sufficient, if the wind continue with the same velocity, to yield a considerable further ascent before the vertical component of pressure is reduced to such an extent that it no longer exceeds the weight of the plane under the constant angle of inclination." Though the conditions of the problem solved by Prof. Curtis are seldom met with in nature, the results he has obtained have a very important bearing upon mechanical flight.

A NUMBER of papers of considerable value are published in the *Mittheilungen der Prahistorischen Commission der Kais. Akademie der Wissenschaften.* (Bd. 1, No 3. Wien, 1893). J. Szombathy describes the ceramics discovered by him in a tumulus at Langenlebarn, in Lower Austria. He points out that double and multiple vessels were common in the finds of the bronze period and first iron age of the eastern Mediterranean countries, especially in Cyprus and Troas, somewhat rarer at a later time in the graves of the first Italian iron age, and still more rare in the later graves of the Hallstatt period of the Austrian Alps and of Central Europe. The doubling arose from the gradual increase in diameter of the lower portion of the long cylindrical neck of an earlier type of vessel. Dr. M. Hoernes gives a study of the forms of various prehistoric objects which he has observed in the museums of North-east Italy. Amongst other objects he refers to bronze and iron knives in the museum at Padua. The resemblances in the handles and ornamentation of certain clay vessels leads him to the conclusion that the culture of the bronze age of North-eastern Italy extended to the East, and included Bosnia-Herzegovina and Istria; but from this he does not deduce an ethnical relationship. In the bronze period of Eastern Upper Italy not only were pile-dwellings inhabited, but mounds as well, as in Istria and Bosnia-Herzegovina. Even if related pile-structures are not to be found in the north-west of the Balkan Peninsula, the difference in the mode of life is counterbalanced by other considerations. The evolution of the Italians and the Illyrians later diverged in the historically well-known way. He would add the Ligurian people as belonging to the same culture group of that age; this culture-unity separated these people from other peoples living further north and south of this zone. Dr. Hoernes also describes some triangular and other ornaments, human and animal forms, especially those with associated birds, as well as bronze and iron fire-dogs. Prof. R. Trampler writes on the oldest graves in the Brünnen Valley district; and F. Heger, on finds from prehistoric and Roman times in Lower Austria. The author of this well-illustrated paper states that there was a pure bronze age in the district of Upper and Lower Austria, which had points of relationship with the Western finds, and especially with those in the North and East.

A CURIOUS formation is illustrated in the first annual report of the Iowa Geological Survey, published a few months ago. Good exposures of limestone rocks are found all along the Mississippi from Keokuk to Burlington, in south-eastern Iowa. The limestone often stands out in overhanging cliffs over the softer shale beds beneath, and gives the appearance of a cascade, as shown in the accompanying illustration, which is reduced from a plate in the report. The Survey was only established in 1892, but the report shows that a large amount of useful information, of great economic interest to the people of the State, has already been collected.



THE volume referred to in the foregoing note showed us that the publications of the Iowa Geological Survey were to be of a high character. The second volume, which reached us a few days ago, goes to confirm this view. It is a description of the coal deposits of Iowa, by Dr. C. R. Keyes, and is a model of what a general report should be. With text running into more than five hundred quarto pages, eighteen full-page plates of a high quality, representing interesting formations in connection with the coal-measures, and over two hundred figures in the text, the volume is an attractive handbook for the coal-miners of Iowa. It is not a detailed account of the geological features of the coal districts—that will follow when sufficient facts have been accumulated; it is rather a preliminary report, somewhat general in character, but sufficient to supply temporarily the demand for information pertaining to the coal deposits of the State. Separate volumes will be devoted to practical mining in Iowa, and to a description of the uses and properties of Iowa coals. We offer our congratulations to Dr. Keyes and the geological corps with which he is associated. May their intentions with regard to future work be satisfactorily realised.

IN the current number of the *Zoologischer Anzeiger* (No. 462), Dr. Arnold Graf records some novel observations made by him in the course of some experiments on the effects of compression on the segmentation of the egg of the sea-urchin *Arbacia*. Driesch has already shown that compression of the segmenting egg between slide and cover-slip leads to the formation of a flat plate of blastomeres, and Dr. Graf's observations coincide completely with those of Driesch up to the 32-cell stage. At this point the author determined to remove the pressure exerted by the cover-slip, and to notice the effect produced on the egg by this reversion to normal conditions. To his astonishment he found that, after removing the pressure (by gradually adding a surplus of water between slide and cover-slip) the various blastomeres began to fuse together again. In this way a plate of 15 cells was produced, each cell containing two and, in a few cases, three nuclei. Shortly afterwards the separate nuclei in each cell reunited. The last transformation observed by the author was the conversion of the plate into a 12-cell stage, consisting of eight macromeres and eight micromeres. The results of the experiment are full of interest, and well worthy of renewed trial. The author is certain that the fusion of the blastomeres took place quite regularly: the two or three daughter-cells of one mother-cell reunited to form the single uni-nucleated equivalent of the mother-cell again.

CERTAIN obscure phenomena connected with the mingling of two masses of liquid are dealt with by Herr E. Kaiser in the current number of *Wiedemann's Annalen*. Two soap-bubbles or two jets of water when brought into immediate juxtaposition will not always mingle at once, and sometimes they will not do so at all. Impurities in the water or soap solution will encourage fusion, and so will a difference of potential. Whether the influence of the latter may be explained on the supposition of sparks breaking down the intervening layer of air, is a question which has been answered in the affirmative. But Herr Kaiser's experiments tend to show that in reality the difference of potential simply increases the pressure on the intervening air, and forces it out at the sides, thus diminishing the distance between the two surfaces down to the radius of molecular action. He suspended a circular film of Terquem's sugar-soap solution in a wire ring by a delicate spring balance, and brought a bubble to bear against it from below. The film and bubble were placed in electric connection through their supports, and differences of potential due to 1, 2, 3 and more Daniells were subsequently introduced. With the films investigated, the time necessary for fusion was about 3·2 seconds with no difference of potential, 1·4 seconds with one Daniell, and 0·4 with two. With more Daniells fusion took place instantly, and the films burst in most cases. The pressure was 1·016 gr. The displacement of air from between the films was studied by the aid of the Newton's rings formed between them. The rings widened out, rapidly at first, then more slowly, and the mingling was heralded by the appearance of the grey-blue of the first order. A difference of potential simply accelerated this process.

IT has been said by someone, that a whole set of meteorological predictions may be disturbed by a cowboy carelessly throwing down a burning match upon a prairie. The match starts a prairie fire which causes changes extending throughout the atmosphere, and so an accident may upset the most carefully prepared forecast. This is, of course, a far-fetched case, but it is worth while knowing what effects great forest fires have upon the atmosphere. To this end Prof. Cleveland Abbe, in the *Monthly Weather Review*, determines some of the meteorological results of the extensive forest fires in the United States during July and August of this year. It appears that, with regard to their influence upon atmospheric moisture, the experience of the past summer is sufficient to show that forest fires are not necessarily followed by rain, and are not a practical method of inducing rain in dry seasons. Comparing the normal maximum effect of solar heat with the computation of the effect of burning forest, Prof. Abbe finds that, in the locality where it occurs, a forest fire can heat its atmosphere more than the hottest sun of June, in the ratio of 10,000 to 750. Fortunately, however, the general influence of the forest fire upon the whole atmosphere is much smaller than that of the sun, because the fire is of small extent, while the sun affects the whole earth. The actual area covered by the forest fires of August in Minnesota, Wisconsin, and Michigan did not exceed five thousand square miles, whereas the area covered by the smoke, and, therefore, hot air, from these fires before the heat was all lost by radiation, was not less than one million square miles. A comparison of the solar effect over this large area and the more intense forest fire effect over the small area, shows that the former is fifteen times that of the latter. Prof. Abbe's calculations thus afford no foundation for the belief that forest fires have important meteorological sequelæ. The story of the connection between careless cowboys and atmospheric circulation is, therefore, no longer worth telling.

THE current number of *L'Elettricista* contains a description of a new method for measuring small resistances, due to Dr. Pasqualini. This method, which requires no special apparatus that cannot be easily set up in the laboratory, consists in having a coil, composed of a few turns of wire, wound double, so that there are two similar circuits. This double coil is fixed to the case of an ordinary galvanometer, so as to act on the needle. The main current sent through the resistance to be measured passes through one of the circuits of this auxiliary coil. A shunt circuit to the resistance is formed by the second circuit of the coil, the galvanometer, and a resistance-box. The connections are so arranged that the main current and the shunt current in the galvanometer coils tend to turn the needle in opposite directions. The resistance of the shunt circuit is varied till the galvanometer deflection is zero. Suppose K is the galvanometer constant, while K_1 is the constant which expresses the effect of either of the circuits in the auxiliary coils on the needle, and if I and i are the total main current and the fraction which passes through the shunt circuit respectively. Then $K\,i = K_1\,I - K_1\,i$, or if R is the resistance of the shunt circuit, the resistance to be measured $= \frac{K_1}{K}R$. The value of the constant $\frac{K_1}{K}$ can be obtained by performing the experiment on a known resistance. With an auxiliary coil consisting of two similar circuits containing four turns each, and a Wiedemann galvanometer of 8 ohms resistance, the author finds he can measure a resistance of ·0002 ohms within $\frac{4}{1000}I$, using a standard ohm to determine the constant $\frac{K_1}{K}$.

IN a paper communicated to the *Physical Review*, Mr. S. H. Brackett gives an account of some experiments he has made on the magnetic properties of iridium. The samples used contained 98 per cent iridium, with some platinum, and a trace of phosphorus, but no iron. A bar of the metal 13·3 m.m. long, 3·2 m.m. wide, and 0·9 m.m. thick, when brought into the field of an electromagnet, set itself at right angles to the lines of force, and became permanently magnetised in a transverse direction, and when suspended, freely set itself E. and W. The permeability of a larger bar was tested, and was found to be unity; and although the specimen was sharply struck while in the magnetising coil, no induced magnetisation was produced.

A NEW illustrated descriptive price list of electric and magnetic apparatus, for use in colleges and scientific institutions, has been issued by Messrs. King, Mendham, and Co., Bristol.

WE have received a *Jahrbuch* containing the results of meteorological observations made at the observatory of the

Magdeburgischen Zeitung during 1893. The volume is edited by Herr A. W. Grützmacher, and is in its thirteenth year.

THE *Bulletins* of the Michigan State Agricultural College Experiment Station, for October, contain an exhaustive paper on the insects which attack clover, by Mr. G. C. Davis, and one on rape as a forage-plant, by Mr. C. D. Smith and Mr. F. B. Mumford.

THE eighth part of "The Natural History of Plants" has been published by Messrs. Blackie and Son. It deals with the genesis of plant-offspring, one section being devoted to asexual reproduction, while the other refers to reproduction by means of fruits.

MM. J. B. BAILLIÈRE ET FILS, of Paris, following other firms of booksellers and publishers, have commenced the issue of a monthly list of new books, under the title *Bibliographie des sciences naturelles.* The list for November comprises the titles and prices of important works on protozoa, sponges, cœlenterata, echinoderms, &c.

THE *Transactions* of the Academy of Science of St. Louis, U.S.A., include a paper on *Sclerotinia Libertiana*, a fungus parasite of the sunflower, by Prof. L. H. Pammel, to which is appended a bibliography of the fungus diseases of roots, covering thirty-seven pages; also a further instalment of Mr. C. Robertson's observations on the relationship between flowers and insects in the process of pollination, the present paper treating of American species of *Rosaceæ* and *Compositæ.*

A VOLUME containing a number of important papers and reports relating to the gold fields of New Zealand has just reached this country. The mining industry has formed a large factor in the advancement of the colony, and the statement issued by the Government shows the direction in which further developments should be made. The volume comprises reports on the gold fields and coal mines, geological reports on the older quartz-drifts in Central Otago, and a report on deep quartz-mining in New Zealand.

MR. EDWARD STANFORD has acted wisely in reissuing Dr. A. R. Wallace's standard work on "Australasia" in a revised and enlarged form. The first volume of the new edition, dealing with Australia and New Zealand, was published a few months ago. The second volume, which has just appeared, has for its subject Malaysia and the Pacific Archipelagoes, being an enlargement of the part devoted to that region in the original work. Dr. F. H. H. Guillemard is responsible for the new work, and he has performed his task so thoroughly that the present volume occupies nearly twice the number of pages previously allotted to the region with which it deals. The work is certainly the most interesting and accurate account extant on the tropical portion of the Eastern Archipelago.

STUDENTS of the anatomy of the horse will be glad to learn that the second volume of the elaborate "Topographische Anatomie des Pferdes," by Drs. W. Ellenberger and H. Baum, has been published by Paul Parey, Berlin. The first volume, dealing with the structure of the limbs of the horse, appeared in the spring of last year. The volume just received has for its subject the head and shoulders; while the third, which the publisher informs us will be issued early next year, will be devoted to the trunk. We shall review the work when it is completed. So far as we can at present judge, it promises to be a useful contribution to the literature of the subject, possessing both scientific and practical importance.

PROF. W. NERNST'S important treatise on "Theoretical Chemistry, from the Standpoint of Avogadro's Rule and Thermodynamics," the German edition of which was enthusiastically received last year, has been translated by Prof. C. S. Palmer, of the University of Colorado, and the translation will shortly be published by Messrs. Macmillan and Co. The work is a development of Prof. Nernst's introduction to the "Handbuch der Anorganischen Chemie" of Dr. O. Dammer. It is, however, quite an independent text-book for students of the new physical chemistry, and includes the results of all recent investigations bearing upon that science. The book will serve at once both as a treatise in itself, and also as an introduction to, and companion in, the larger field covered by the *Zeitschrift für Physikalische Chemie* and the related literature.

ANOTHER scientific work which Messrs. Macmillan will shortly issue, is "Steam and the Marine Steam Engine," by Mr. John Yeo. The book is chiefly intended for naval officers, and for students of engineering in the earlier part of their training. It aims especially at giving a sound general knowledge of the propelling machinery of ships, and of various matters connected with its use and management.

IN "Darwinism and Race Progress," which Messrs. Swan Sonnenschein and Co. will shortly publish, Prof. Haycraft shows how the racial deterioration which would of necessity ensue upon our modern care of the sickly and enfeebled, may be counteracted by a keener public conscience. Our preservation of unworthy types by public and private charity is strongly animadverted upon, and with regard to intellectual development, it is pointed out that the present democratic movement, while it gives a chance to the clever and capable of becoming educated and well-to-do, entails upon them conditions which generally imply late marriages and relative sterility. Without supplementary action, nothing could be devised which would more effectually breed capacity out of the race.

TWO volumes have lately been added to the comprehensive engineering division of the Encyclopédie Scientifique des Aide-Mémoire, published jointly by Gauthier-Villars and Masson. They are "Les Chronomètres de Marine," by M. E. Caspari, and "Torpilles Sèches," by M. E. Hennebert. As is the case with all the volumes in the same series, the two new ones are practical handbooks of a very instructive character. In the former, the construction of chronometers, and the theory relating to it, are clearly described, and a deal of space is devoted to the effects of various conditions upon the rate, and also to the determination of the coefficients of the rate-formula. The determination of longitude by means of chronometers, and the methods of testing and comparing the instruments, are concisely described. Both M. Caspari's work, and that by Lieut.-Colonel Hennebert on torpedoes, bring together a lot of scattered information of great use to students of the subjects with which they respectively deal.

COMMERCIAL geography is just the kind of subject to be fostered by County Councillors, hence, from the time that the Technical Instruction Act came into operation, there has been an increasing demand for text-books upon it. The first edition of Dr. H. R. Mill's "Elementary Commercial Geography," in the Pitt Press Series (Cambridge University Press), appeared in 1888, when the boundary line of commercial geography was in a more or less nebulous condition. Thanks to the impetus that has been given to the subject during the past few years, the book has reached a second edition. The new issue is not, however, merely the original work reprinted, for it has almost entirely been rewritten. To quote the preface: "The book has been revised throughout by the aid of official publications, and the facts are as far as possible brought down to date. It is enlarged by treating more fully of the principles of commercial geography, by describing the African possessions of the European powers in greater detail, and by many small additions in every chapter."

These additions have enlarged the book from 132 to 181 pages, and have correspondingly increased its value. It would be difficult to find an elementary class-book of commercial geography constructed on better lines, or in which the information is more concisely and accurately stated.

THE additions to the Zoological Society's Gardens during the past week include a Spotted Owl (*Athene brama*), four Grey Francolins (*Francolinus ponticerianus*), three Rain Quails *Coturnix coromandelica*), an Indian House Sparrow (*Passer domesticus*), two Red-headed Buntings (*Emberiza luteola*), two Nutmeg Finches (*Munia rubro-nigra*), a Spotted Turtle Dove (*Turtur meena*) from India, presented by Mr. E. W. Harper, a West African Love Bird (*Agapornis pullaria*) from West Africa, presented by Mrs. Robinson; a Reticulated Python (*Python reticulatus*) from Malacca, presented by Mr. Sigismund Bruzaud; an American Black Bear (*Ursus americanus*, var. *cinnamonea*) from the Rocky Mountains, two Common Cassowaries (*Casuarius galeatus*) from India, a Red-vented Parrot (*Pionus menstruus*), two Orange-flanked Parrakeets (*Brotogerys pyrrhopterus*) from South America, a Scops Owl (*Scops* ——) from Formosa, deposited; a Short-billed Toucan (*Ramphastos brevicarinatus*) from Central America, received in exchange.

OUR ASTRONOMICAL COLUMN.

MOTION AND MAGNITUDE.—Students of elementary astronomy often believe that stellar motions in the line of sight soon produce changes in the magnitudes of stars. Motion towards the earth involves, of course, a certain increase of magnitude, and a motion of recession must carry with it a decrease, but the amount in the case of a star is far too small to be measurable, even if the magnitudes are observed during many generations. At the meeting of the Amsterdam Academy on November 24, Prof. Oudemans communicated the results of an investigation to determine exactly how long stars of which the velocity in the line of sight are known would have to go on moving, in order to produce a change of 0·1 magnitude. From his own list of parallaxes in vol. 122 of the *Astr. Nachrichten*, and Vogel and Scheiner's list of proper motions in the line of sight ("Potsdam Observations," vii. i. p. 153, 154), fourteen stars were selected, four of them receding from, and the remaining ten approaching, the solar system. Adopting a solar parallax = 8″·815, and the logarithm of the proportion of the increase of brilliancy for one magnitude = 0·400, he found that the period required is given by the formula

$\frac{6195}{\text{parallax} \times \text{motion}}$ years for stars that are receding from,

and $\frac{5916}{\text{parallax} \times \text{motion}}$ years for those that are approaching

to the solar system; the parallax being expressed in seconds, and the motion in geographical miles (1 geographical mile = 4·61 English miles). Aldebaran proved to be the only star of which the brightness could, since Ptolemy's time, have experienced a loss of 0·1 magnitude by its radial motion, provided that the parallax 0″·52, found by Otto Struve, is trustworthy. Elkin found a value = 0″·12, and adopting this value, the period becomes 4⅓ times longer. For the other stars the result was 5500 years at least for Procyon; while most of them gave ten-housands of years as the result.

THE RECENT TRANSIT OF MERCURY.—Details of several of the American observations are published in *Astronomical Journal*, No. 330. At most of the stations, some of the contacts could not be observed on account of clouds, but, on the whole, a fair amount of success attended the observers. Prof. Young observed the first and second contacts, and reports that there was a sort of "hardening" of the sun's limb close to the expected point of first contact a few seconds before the actual contact took place; he has now observed this phenomenon four times, and states that "it may be due to the planet's obscurvation of the brightest part of the chromosphere close to the disc of the sun, or to some diffraction effect at the limb of the planet." A large "black drop" was observed two seconds before the second contact. Prof. Todd failed to observe the contacts on account of unfavourable weather, but obtained some results during the passage across the disc. He says:—"The planet appeared perfectly circular, sharply defined about the limb, unattended by any halo or atmospheric ring, and of the same colour as the umbræ of the spots on the sun. No attendant satellite of Mercury was seen, nor could any bright spot be discerned upon the centre of the disc, although intently looked for. Any satellite smaller than 100 miles would have escaped detection."

THE NEW ACHROMATIC OBJECT-GLASS.—*Engineering* for November 23 and 30 contains a full account of a fine 12½ inch equatorial that has just been built by Messrs. Thomas Cooke and Sons, York, for the new observatory at Rio de Janeiro, together with a sketch of the Buckingham Works at York. The description is accompanied with twenty-nine detailed drawings of the instrument. It appears that the works are the only ones in this country where every part of a modern astronomical telescope is constructed; with the exception of the actual making of the glass, everything is done on the premises, even the heavy cast-iron pillars being made in the firm's own foundry. The new instrument, with Messrs. Cooke's standard form of equatorial mounting for large refracting telescopes, is fully equipped for all branches of astronomical research. The clock, too, has all the latest improvements for adjustment. The object-glass is of the three lens form, invented by Mr. Taylor, who deserves the thanks of astronomers for producing an objective which, whilst made of durable kinds of glass, and of moderate focal length, is perfectly achromatic. How this end is attained was described in these columns on March 15 (vol. xlix. p. 464). A section of the lens is shown in Fig. 1. The first, L_1, is made of baryta light flint, having a refractive index of 1·5637 for the D ray, and its reciprocal of dispersive power is 50·6. The second lens, L_2, is made of a new glass known as boro-silicate flint. This glass has a refractive index of 1·54685 for the D ray, and the reciprocal of its dispersive power is 50·2. The third lens, L_3, is made of light silicate crown glass having the following characteristics: refractive index for D ray, 1·5109; reciprocal of dispersive power 60·4. By suitably proportioning the various radii of the lenses, the middle negative lens may be made to almost exactly compensate for the dispersion effected by the other two, and this without necessitating any exceptionally great focal length. If necessary this may be made so small as fifteen times the aperture, and there is no difficulty whatever in making a glass with a focal length of eighteen apertures. A small space is provided between the second and third lens, the object of this being to make the correction for spherical aberration as complete as possible; and when the thickness of this space is properly proportioned, there is an entire absence of spherical aberration for all colours of the spectrum. Object-glasses made on this plan have been tested by astronomers for visual and photographic observations. In both cases the stellar images showed no indications of residual colour, the lenses behaving just like the mirror of a reflector.

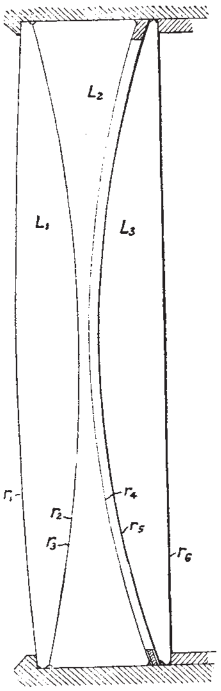


FIG. 1.—Section of the New Object-glass.

EPHEMERIS FOR SWIFT'S COMET.—The surmise noted in these columns last week has proved to be correct. M. Schulhof shows pretty conclusively, in the current *Comptes-rendus*, that Swift's new comet is really identical with De Vico's comet 1844 I. The subjoined ephemeris is from one given by Prof. Lamp in the *Astronomische Nachrichten*, No. 3266.